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Title: U.S. Nuclear History and Weapons/Platforms Overview

Author(s): Scarlett, Harry Alan

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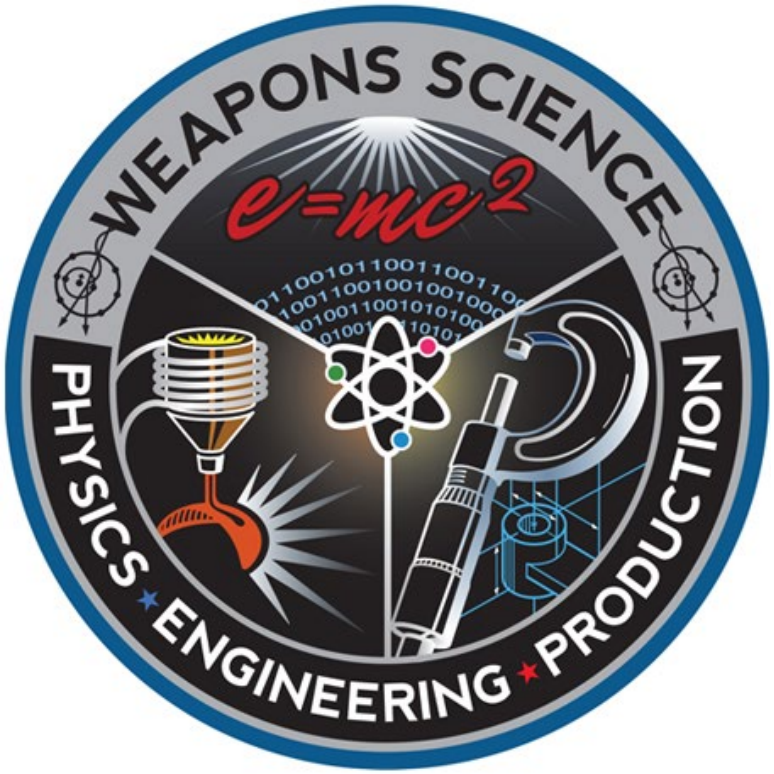
Nuclear Fundamentals Orientation Module 2

U.S. Nuclear History and Weapons/Platforms Overview

National Nuclear Security Administration
Managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA

U.S. Nuclear History and Weapons/Platforms Overview



Presentation Overview:

- History
  - Basic Definitions
  - Why We Have Nuclear Weapons
  - Governance of U.S. Nuclear Weapons
  - Guidance
  - Who Decides & Modifies the Stockpile
  - Weapon Testing & Stockpile Stewardship
  - Nuclear Weapons Lifecycle Overview
- Weapons/Platforms Overview
  - Navy Weapons/Platforms
  - Air Force Weapons/Platforms
  - Stockpile Modernization
  - Future Weapon/Platform Capabilities
- References and Recommended Reading
- Questions and Answers

Basic Definitions

- U.S. Nuclear Weapons Program: represents all activities, processes and procedures associated with nuclear weapons. The program encompasses the infrastructure and resources - human and material - necessary to support the United States (U.S.) policy of deterrence. That deterrence minimizes the possibility that the U.S. will be attacked by nuclear warheads or other Weapons of Mass Destruction (WMDs) from a foreign adversary.
  - The term “Nuclear Warheads” formally represents both nuclear bombs and nuclear weapons (missiles), but often the term “Nuclear Weapons” (NW) is also used to mean both.
  - At LANL, we have historically used the terms “weapons” and ”weapons program” – these terms are imprecise. When you’re talking with anyone in the Department of Defense (DoD), you should specify *nuclear weapons*.

Basic Definitions, continued

- Nuclear Weapon – An atomic weapon that includes a delivery vehicle, a nuclear explosive package, and all the radar, fusing, arming, and firing equipment needed to deploy it.
- Delivery Platforms – The DoD assets that deliver a nuclear weapon to a target
  - Planes with nuclear bombs or Air Launched Cruise Missiles (ALCMs)
  - U.S. Silos with Intercontinental Ballistic Missiles (ICBMs)
  - Submarines (Subs) and their Sub Launched Ballistic Missiles (SLBMs)

Why We Have Nuclear Weapons

- A key part of the defense of the U.S. is that we maintain a safe, secure, and effective nuclear weapons posture.
- The U.S. Nuclear Stockpile, by its mere existence, provides a military and political deterrent to our global adversaries.
- Even though our nuclear weapons have not been used (since the end of World War II (WWII)), they are effectively, “in use” every day!
- Nuclear weapons provide a significant deterrent to any nation that wants to do us harm. That has been true ever since they were created.
- Our national freedom is supported by the U.S. nuclear stockpile as long as it is viewed as a credible deterrent.
- By maintaining this posture the U.S. and our allies have and will avoid large wars and the resulting loss of life.

During WWI & II 70-100 million people died in a 30+ year span.
Since WWII only 7-10 million lives have been lost
in conflicts across the world in the last 75+ year span!

Governance of Nuclear Weapons

- **Beginning Concept – Today**
  - 1939 Albert Einstein's Letter to President Roosevelt
  - 1942 Manhattan Project authorized to develop a weapon
  - 1943 Los Alamos National Laboratory established
  - 1945 Two nuclear bombs were dropped on Japan
  - **1946** Atomic Energy Commission (AEC) formed
  - 1953 AEC signed, with the Department of Defense (DoD), a directive for the joint development, production, and standardization of atomic weapons. Agreement still in use today and has been updated several times.
  - **1974** AEC transformed into Energy Research and Development Agency (ERDA)
  - **1977** Department of Energy (DOE) formed and assumed AEC/ERDA duties creating an Executive Cabinet level office overseeing nuclear weapons program
  - **2000** National Nuclear Security Administration (NNSA) established within DOE as a semi-autonomous agency which assumed responsibility for the U.S. nuclear weapons complex and associated nonproliferation activities.

Governance of Nuclear Weapons, continued

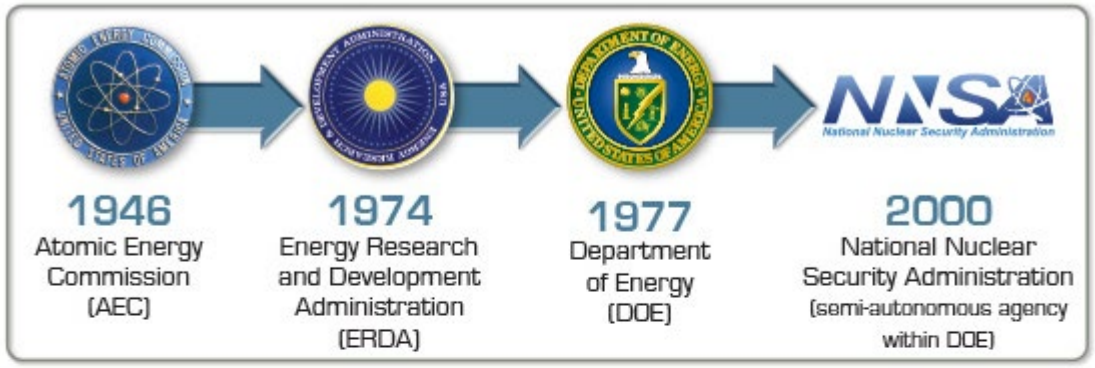
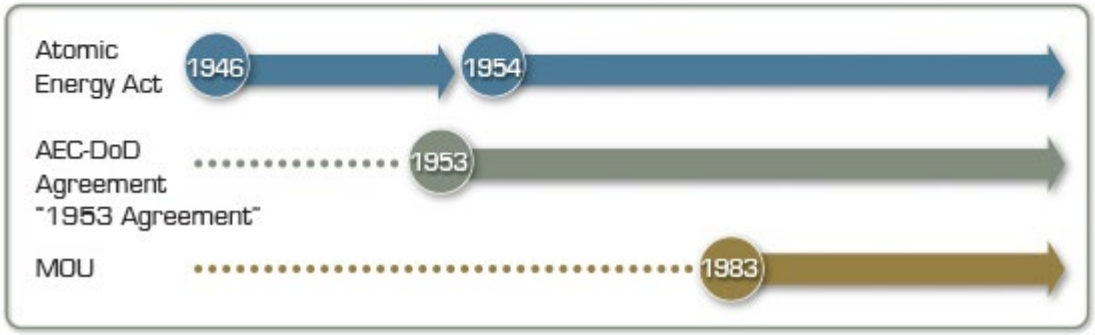
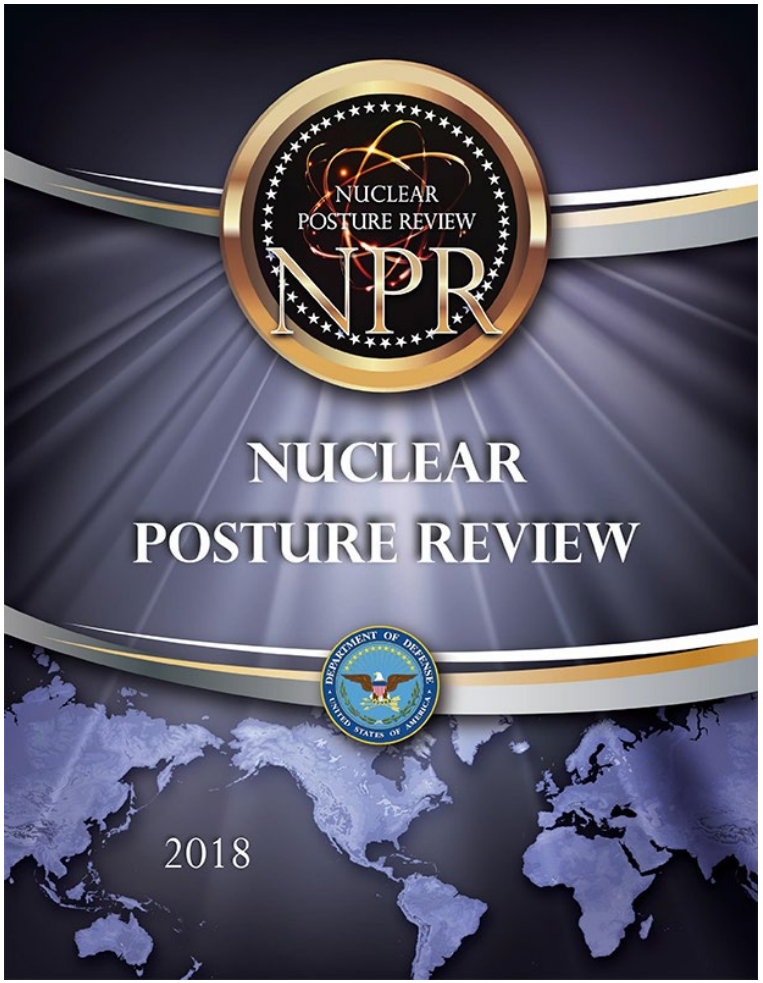


Figure 5.4 AEC to NNSA



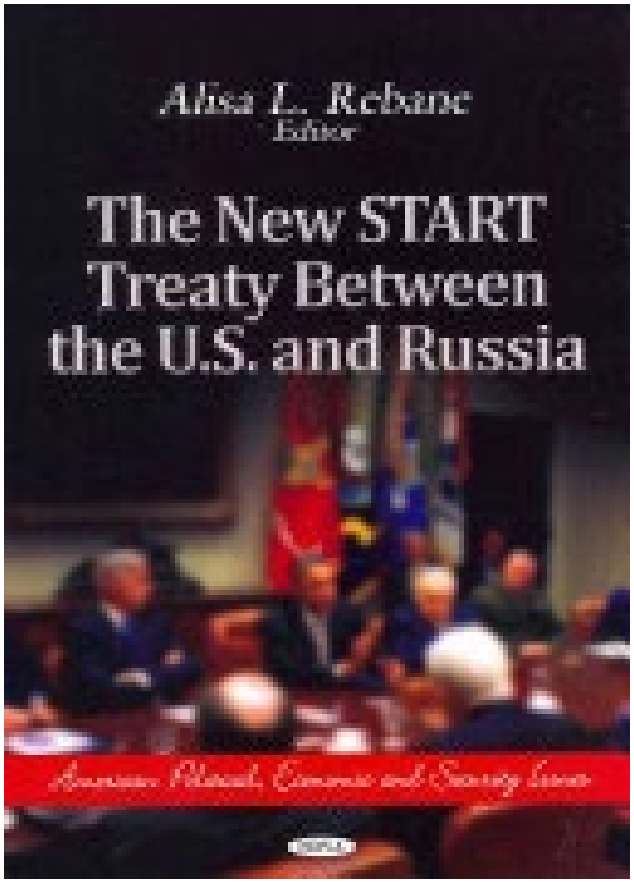
Guidance

- The **Nuclear Posture Review** is a legislative-mandated review undertaken by the Department of Defense about every eight years. It outlines U.S. nuclear policy, strategy, capabilities, and force posture for the next five to ten years.



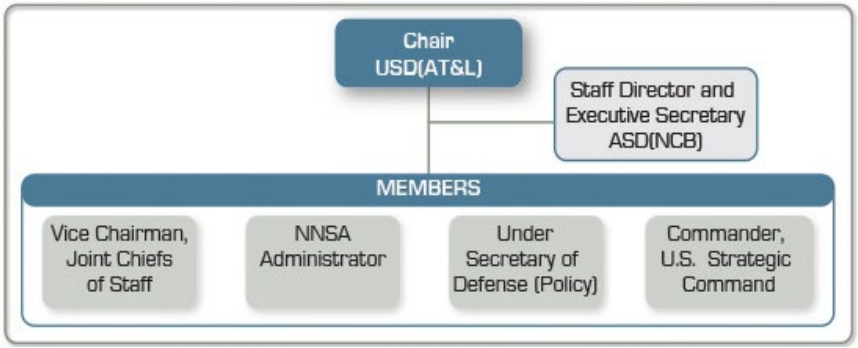
Guidance, continued

- Treaties (legally binding)
  - Establish limits on strategic weapons
  - Prohibit types of delivery
  - Create a level of trust
- New Start Treaty expires February 2021, unless extended



Who Decides and Modifies the Stockpile

- The Nuclear Security Enterprise (NSE) working with the DoD (STRATCOM and Navy or Air Force) develops recommendations on what modifications a weapon may need.
- The NSE & DoD make recommendations to the Nuclear Weapons Council Standing and Safety Committee (NWCSSC) and if approved forwards the recommendation to the Nuclear Weapons Council (NWC). (The committee process is iterative and takes time.)
- The NWC, after reviewing recommendation for a weapon, then decides if the weapon will be modified.
- The process then proceeds for funding approval in Congress & Legislative branches of government



Who Decides and Modifies the Stockpile, continued

- The NSE includes:
  - NNSA - The Federal Agency in charge of the NSE
  - Design Agencies (DA) – Design Labs: LANL, Sandia National Laboratory (SNL), Lawrence Livermore National Laboratory (LLNL)
  - Production Agencies (PA) – Plants: Pantex (PX), Kansas City National Security Campus (KCNSC), Y-12 National Security Complex (NSC), Savannah River Site (SRS), LANL - Pits & Dets, and SNL - NGs & miscellaneous

- The NWC is composed of 5 members:
  - Under Secretary of Defense for Acquisitions, Technology & Logistics is the Chairman
  - Under Secretary of Defense for Policy
  - Vice Chairman for Joint Chiefs of Staff
  - Commander of the U.S. Strategic Air Command
  - DOE NNSA Administrator

- The NWCSSC is a standing committee under the NWC that coordinates all recommendations going to the NWC

Who Decides and Modifies the Stockpile, continued

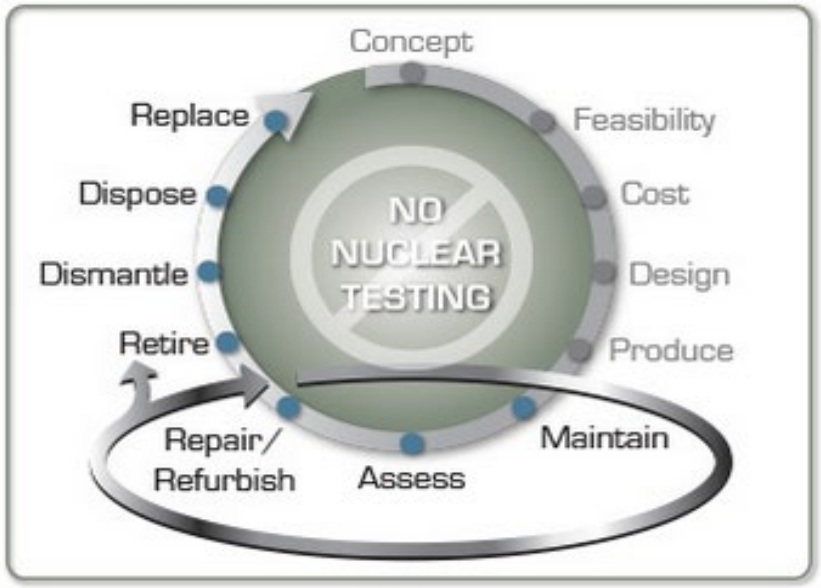
- DoD & DOE Roles & Responsibilities
  - DoD is responsible for the design, development, production, and dismantlement of weapon delivery systems. DoD also develops weapon requirements that NNSA must deliver.
  - NNSA, an agency within DOE, is responsible for the design, development, production, updating, and dismantlement of nuclear warheads, nuclear weapons trainers, and ancillary equipment.

Weapon Testing

- The Trinity Test was the first nuclear weapon detonation. It occurred in the Summer of 1945 near Alamogordo, New Mexico, just prior to dropping the two nuclear bombs on Japan.
- Many other nuclear tests were performed after WWII as the U.S. and the Soviet Union built weapons. These tests validated new weapon performance and became the basis for the U.S. certifying a weapon as safe, secure, reliable and effective before it entered the U.S. Stockpile.
- Initial nuclear tests were conducted above ground and at sea.
- In 1963, a “Limited Nuclear Test Ban Treaty” was signed (U.S. & USSR) based on the realization nuclear testing was an increasing source of radioactive contamination to the atmosphere, oceans, and outer space. Thus underground testing became the U.S. policy and remained so until1992.
- As other nations developed their weapons, many started to follow the same protocol for validating weapon performance.

Stockpile Stewardship Program

- The Stockpile Stewardship Program (SSP) was created to allow the U.S. to halt underground nuclear testing (1992).
  - However, the data obtained from past underground tests are used extensively to validate models for today's and the future stockpiles
- The SSP is what we use today to certify the weapons that undergo modernizations. Advanced computer modeling, new analytical technologies, new experimental capabilities, and sub-critical nuclear testing are part of the SSP that we are using today.



Stockpile Management
1992-Present

Nuclear Weapons Lifecycle Overview

- The current nuclear stockpile is constantly aging, which sometimes results in a warhead's component(s) to degrade (becomes less safe, secure, reliable or effective).
- Weapon issues, when they occur, are addressed in one of three ways:
  - **Modifications (Mods)** – make some change to weapon component(s) to alter the weapon's operational capabilities, safety or control features, or technical procedures
  - **Alterations (ALTs)** – make a change to a component(s) that does not change the weapon's capabilities listed under a Mod, and the changes are "transparent" to the user (military units)
  - **Life Extension Programs (LEPs)** – alter several components to extend service life of weapon

Nuclear Weapons Lifecycle Overview, continued

- 6.X Process - used to modify existing stockpile weapons

Phase 6.1	Phase 6.2	Phase 6.2A	Phase 6.3	Phase 6.4	Phase 6.5	Phase 6.6
Concept Assessment	Feasibility Study and Design Options	Design Definition and Cost Study	Development Engineering	Production Engineering	First Production	Full-Scale Production

- The 6.X process is very similar to the original, eight phase weapon lifecycle that the nuclear arsenal was built and tested under
- 6.X was tailored to enable life extension and modernization work on the current stockpile, while still linking/validating the modernizations to the underground test results that preceded the changes. This ensured weapons remained safe, secure, reliable & effective!
- The 6.X process is what the NSE has used since 1992.
  - NNSA Supplemental Directive (SD) 452.3-2 establishes NNSA policy.
  - Defense Programs Business Process System (DPBPS) R006 establishes the process for the enterprise.

Nuclear Weapons Lifecycle Overview, continued

- Eight phases - originally used to develop a weapon

  (*are very similar to the 6.X Process used to modify a weapon*)

Phase 1	Phase 2	Phase 2A	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
Concept Definition Studies	Feasibility Studies	Design Definition and Cost Studies	Development Engineering	Production Engineering	First Production	Quantity Production	Dismantlement

  - Phases 1 - 2A: Determine concepts and scope costs of a proposed concept to meet a military application
  - Phases 3 - 5: Gear up the Nuclear Security Enterprise design and production processes
  - Phase 6: Field and maintain the weapons in the stockpile
  - Phase 7: Return and dismantle weapons

Nuclear Weapons Lifecycle Overview, continued – Phases 1 – 2A: Concepts and Scope Costs

- **Phase 1:** DoD and DOE/NNSA may independently or jointly conduct a Phase 1 study after the secretary of defense approved concept meets a DoD mission need. Military Characteristics (MCs), Stockpile to-Target Sequence (STSs) and a Planning Information Document (PID) are drafted.
- **Phase 2:** NNSA NWC requests and DoD provides major weapons and warhead information. Major Impact Report (MIR) prepared that identifies the key factors in meeting program objectives and sets target dates for baseline design definition. Labs prepare competitive proposals and NNSA down-selects design team and proposal; Project Officers Group (POG) established and refines MCs & STSs, and Phase 2A scope & schedule established.
- **Phase 2A:** A Phase 2A study (if required) is developed, while the DAs submit designs to the PAs of the NSE for production cost estimates. The POG conducts cost/benefit tradeoff studies to balance requirements and resources and a Weapon Design and Cost Report (WDCR) is provided to the NWC.

Nuclear Weapons Lifecycle Overview, continued – Phases 3 – 5: Gear up the NSE Design and Production

- **Phase 3:** Defines a tested, makeable weapon design. This starts the NSE product realization process where MC and STS requirements are decomposed to subsystem, assembly, subassembly, component, and material requirements. Drawings and specifications are developed, an Advance Planning Document (APD) is issued by NNSA, a Pilot Production Program Definition (PPPD) is approved, and Prototype products are fabricated. An independent peer review (IPR) is performed on the nuclear design and the Preliminary Weapon Development Report (PWDR) is developed. SNL Military Liaison and Defense Threat Reduction Agency (DTRA) defines all base spare parts needed, a joint test working group (JTWG) is established to provide technical guidance for post-development testing, and a new material and stockpile evaluation schedule (NMSES) is developed. The Design Review and Acceptance Group (DRAAG) reviews the PWDR, baseline design, and design reports for the NWC; production schedules and the date for the first production unit is firmed up, and finally, the WDCR is updated to become the baseline cost report.

Nuclear Weapons Lifecycle Overview, continued – Phases 3 – 5: Gear up the NSE Design and Production

- **Phase 4:** Pantex obtains hardware for training of assembly processes, tooling, personnel, and nuclear safety studies. NNSA issues the Program Control Document (PCD) to define production quantities and delivery schedules. Process Prove-in (PPI) and Quality Evaluation (QE) hardware are tested. DAs issue qualification engineering releases to authorize product for delivery and use.
- **Phase 5:** Initial production begins and receives acceptance stamps, and is accepted by NNSA as war reserve (WR). DAs prepare the final weapon development report, DAs\NNSA issue a Major Assembly Release to state that the WR weapon material is satisfactory for release to DoD for specified capabilities and uses; any limitations and exceptions are documented. DRAAG conducts a final review before Phase 6 and determines if product may go to stockpile.

Nuclear Weapons Lifecycle Overview, continued – Phase 6: Quantity Production

- **Phase 6:** PAs produce and deliver quality product in accordance with the Product Change Proposal (PCP). Production quantity, quality, schedule, and cost are monitored and controlled by NNSA. Surveillance activities are conducted. Annual assessment is performed. Product changes may be requested through the PCP process (e.g., alterations, modifications). Within Phase 6, life extension activities can occur via the Phase 6.X process.

Nuclear Weapons Lifecycle Overview, continued – Phase 7: Dismantlement

- **Phase 7:** Weapons are returned to Pantex for disassembly. Scheduling is documented in the PCD and Production & Planning Document (P&PD). If or as necessary, safety documents and safety basis are updated. Retirement Disposition Instruction (RDI) is issued by NNSA. Trainers and handling gear are returned from DoD for disassembly and disposal. If return configurations are required, shipping configurations Alterations (Alts) are documented through Technical Publications (TPs) by Military Liaison (ML). Management and Operation (M&O) provide to NNSA lists of dedicated related components, tooling, and acceptance equipment for disposal. Part dispositions are determined, including need to retain to support other programs. Disposition/sanitization is executed.

U.S. Stockpile

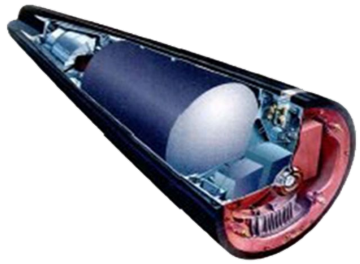
- There are seven Nuclear Weapon types in the stockpile:

B61, W76, W78, W80, B83, W87, W88

Navy Weapons/Platform – W76 & W88/SSBN

Ohio-Class SSBN

- **Builder:** General Dynamics Electric Boat Division
- **Date Deployed:** Nov 11, 1981 (USS Ohio)
- **Propulsion:** One nuclear reactor, one shaft
- **Length:** 560 feet (170.69 meters)
- **Speed:** 20+ knots (23+ miles per hour)
- **Crew:** 15 Officers, 140 Enlisted
- **Armament:** 20 tubes for D-5 Trident II Missile, four torpedo tubes
- **Current Fleet:** 14



Los Alamos NATIONAL LABORATORY EST. 1943

W76

- **Entered Stockpile:** 1978
- **Variants:** Mod 0, 1, 2

W88 ALT 370

W88

- **Entered Stockpile:** 1988
- **Variants:** 0

Air Force Weapons/Platforms – W80/B-52H

B-52H

- **Builder**: Boeing Military Airplane Co.
- **Entered Service:** May 1961
- **Current Fleet:** 46
- **Payload:** 70,000 lbs.
- **Crew:** 5

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Lawrence Livermore National Laboratory

W80

- **Entered Stockpile:** 1982
- **Variants:** Mod 1
- Previous LANL weapon, now LLNL

Air Force Weapons/Platforms – B61 & B83/B-2

Lawrence Livermore National Laboratory

B83

- **Entered Stockpile:** 1983
- **Variants:** Mod 1

B-2

- **Builder:** Northrop Grumman
- **Entered Service:** 1989
- **Current Fleet:** 20
- **Payload:** 40,000 lbs.
- **Crew:** 2

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B61

- **Entered Stockpile:** 1968
- **Variants:** Mods 3,4,7,11

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Air Force Weapons/Platforms – W78 & W87/ICBM

Minuteman III ICBM

- **Builder**: Boeing
- **Entered Service:** 1970
- **Can Deliver MIRVs to a target**

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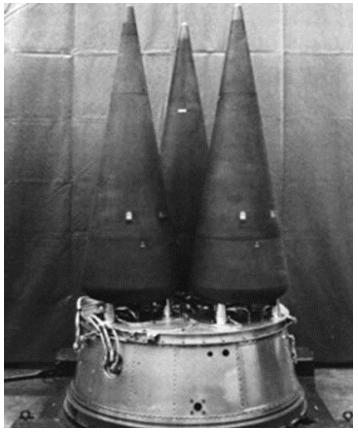
Lawrence Livermore National Laboratory



W78

- **Entered Stockpile:** 1979
- **Variants:** 0

W87

- **Entered Stockpile:** 1986
- **Variants:** 0

Stockpile Modernization

- **Active Stockpile Maintenance consists of:**
  - B61-12 Life Extension Program
  - W76-1 Life Extension Program
  - W80-4 Life Extension Program
  - W87-1 Life Extension Program
  - W88 Alteration 370

The Legacy Stockpile contains weapons that are 30-40 years old. Thus to ensure NWs remain safe, reliable, and meet performance requirements we must refurbish them as necessary to extend their lifetimes.

Stockpile Modernization - Change Status

- The status of five Nuclear Weapon types undergoing change:

  W76, B61, W88, W80, W78

Future Weapon Capabilities

- Future Strategic Sea-based Warhead (FSSW)
  - New warhead planned for SLBM projected for late 2030s
- Future Strategic Land-based Warhead (FSLW)
  - New warhead planned for ICBM projected for late 2030s

Future Platform Capabilities

- **Additions & Changes to Deployment Systems**
  - F35/Dual Capable Fighter Aircraft, mid 2020s
  - Ground Based Strategic Deterrent (GBSD), early 2030s
  - Columbia Class SSBN, early 2030s
  - Long Range Standoff Weapon (LRSO), early 2030s
  - B-21 Raider, mid 2030s
  - D5 Missile LE2, mid 2030s
  - B-52H, Life Extension out to 2050

References and Recommended Reading

- *The Nuclear Matters Handbook 2020,* https://www.acq.osd.mil/ncbdp/nm/nmhb/index.htm
- *Phase 6.X Process,* NNSA Supplemental Directive 452.3-2, January 19, 2017, https://directives.nnsa.doe.gov/supplemental-directive/sd-0452-0003-2/@@images/file

U.S. Nuclear History and Weapons/Deployment Overview

Summary

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Thank you!

Questions?

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